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# MEMORANDUM OF UNDERSTANDING

BETWEEN THE

NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
OF THE UNITED STATES OF AMERICA

AND THE

EUROPEAN SPACE AGENCY

CONCERNING THE

MARS EXPRESS MISSION

## Preamble

The National Aeronautics and Space Administration of the United States (hereinafter referred to as "NASA")

and

The European Space Agency, an international intergovernmental organisation established by the Convention, which entered into force on 30 October 1980 (hereinafter referred to as "ESA")

Collectively hereinafter referred to as "the Parties,"

RECALLING that ESA has embarked on the development of a mission to the planet Mars, called the Mars Express mission,

RECALLING that NASA has embarked on a series of missions to the planet Mars as part of its Mars Exploration Program,

DESIRING to increase the scientific knowledge about the planet Mars,

RECOGNISING the benefit for both Parties of cooperation on Mars exploration,

HAVE AGREED as follows:

## Article 1
## Memorandum of Understanding (MOU) Objectives

1.1 This Memorandum of Understanding (MOU) shall define the terms and conditions by which relevant aspects of the cooperation between the Parties shall be conducted within the framework of the Mars Express mission.

1.2 This MOU is designed to facilitate cooperation between the Parties with respect to the Mars Express mission. It describes managerial, technical, and operational interfaces between the Parties, which are necessary to ensure continuation of and compatibility between their respective activities.

1.3 The primary activities addressed in this MOU concern telecommunications necessary for Mars Express mission operations, navigation (including navigation validation), and data acquisition. The MOU also addresses the Parties' cooperative science activities.

## Article 2
## Mars Express Mission

2.1 The Mars Express mission will study both the Martian atmosphere and the surface of the planet. The payload is designed for observations of the Martian surface from a near-polar orbit with a pericentre height of 250 km and an apocentre height of 14887 km. The apocentre will probably be lowered to 13448 km, 440 days after arrival at Mars. A lander, Beagle 2, will be carried by the Mars Express orbiter and will be delivered to the Martian surface. It will address geochemistry and exobiology. In particular, it will study the morphology and geology of the landing site, the chemical and mineralogical composition of Martian surface rocks and soils, and the potential signatures of life using a robotic mobile device.

2.2 Mars Express mission parameters and launcher capability are optimised for the launch opportunity between late May and late June 2003. The launch will be performed on a Soyuz/Fregat launcher from Baikonur, Kazakhstan. ESA's European Space Operations Centre (ESOC) will conduct mission operations nominally using the New Norcia ground station in Australia.

Critical mission milestones are:

| | |
|---|---|
| Launch: | Between 23 May and 21 June 2003 |
| Lander Separation | Between 16 December 2003 and 1 Jan 2004 |
| Mars Orbit injection: | Between 21 December 2003 and 6 Jan 2004 |
| Lander on surface: | Between 21 December 2003 and 6 Jan 2004 |

Critical mission parameters are:

| | |
|---|---|
| Planned prime landing site: | Isidis Planitia |
| Nominal orbit: | 250 x 14887 km |
| Lowered after 440 days to: | 250 x 13448 km |
| Inclination: | 86.6° |
| Nominal lifetime: | 1 Martian Year |
| Consumables for: | 2 Martian Years |

2.3 The Mars Express mission will conform to Committee on Space Research (COSPAR)-promulgated planetary protection guidelines for Mars missions as a baseline for the orbiter (Category III) and for the lander (Category IVa), as resolved under COSPAR Decision 1/94 (COSPAR Information Bulletin 131, 30, 1994). These guidelines are described in the ESA/Astrium Payload Interface Document-A.

**Article 3**
**Telecommunications**

3.1 Recognizing that compatibility among the various surface and orbital spacecraft elements at Mars, and between those elements and the Earth during the December 2003 through October 2005 timeframe will greatly facilitate telecommunications, the Parties shall ensure interoperability of telecommunications systems.

3.2 Pursuant to this MOU, NASA shall use its Deep Space Network (DSN) to provide telecommunications support for the Mars Express Orbiter. In addition, NASA shall use its 2001 Mars Odyssey Orbiter to support the Beagle 2 lander by facilitating data and command transfer.

3.3 ESA plans to use its Mars Express Orbiter to support a telecommunications test with NASA's 2003 Mars Exploration Rover-2003 (MER-2003) and to provide operational communications support for subsequent NASA missions during the life of the Orbiter. The Mars Express Mars UHF Radio Telecommunications Relay Subsystem may serve the telecommunications needs between the Mars Express Orbiter and NASA's Mars surface assets. The User Interface requirements for the Relay Subsystem are established and maintained as an ESA task. Current plans for services include Beagle 2 and MER-2003.

## Article 4
## Scientific Investigations

4.1 The Mars Express Orbiter's science payload represents the core of the mission. The Orbiter's key scientific objectives include high-resolution imaging and mineralogical mapping of the surface, radar sounding of subsurface structures, precise determination of the atmospheric circulation and composition, and the study of the interaction of the atmosphere with the interplanetary medium. The primary Orbiter instruments are listed below.

- High-Resolution Stereoscopic Camera (HRSC)
- Observatoire pour la Minéralogie, l'Eau, les Glaces et l'Activité (OMEGA)
- Planetary Fourier Spectrometer (PFS)
- Spectroscopic Investigation of the Characteristics of the Atmosphere of Mars (SPICAM)
- Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS)
- Analyser of Space Plasmas and Energetic Atoms (ASPERA)
- Mars Radio Science Experiment (MaRS)

4.2 The Orbiter also is designed to carry a 70kg-class lander called Beagle 2. Beagle 2 intends to address meteorology and climatology, landing site geology, mineralogy and geochemistry, physical properties of the atmosphere and surface layers, and exobiology in the search for signatures of life. The lander is designed to deploy a robotic sampling arm, which holds different types of tools and can retrieve samples for in-situ analysis by instruments mounted on the lander platform. One of the tools to be deployed by the arm is a 'mole' capable of subsurface sampling to reach soil unaffected by solar UV radiation. The following set of instruments and mechanisms is planned for in-situ analyses:

- Gas Analysis Package
- Rock and Soil sampling systems
- Microscope and stereo wide-angles cameras
- Mössbauer and X-ray spectrometers
- Environmental sensors

4.3 NASA plans to contribute to the Mars Express mission's scientific payload primarily through bilateral cooperation with the Italian Space Agency for the development and delivery of the MARSIS instrument. NASA also intends to engage in bilateral cooperation with the Swedish Institute of Space Physics for the development of hardware for the Swedish-led ASPERA-3 instrument. In addition, NASA plans to support U.S. scientists selected for the Italian MARSIS, Swedish ASPERA-3, French SPICAM, Italian PFS, German HRSC and MaRS, as well as on the United Kingdom-led Beagle 2. NASA support for MARSIS, ASPERA-3, SPICAM, PFS, HRSC, MaRS, and Beagle-2 is separately funded and addressed in individual agreements with the respective countries.

## Article 5
## Programmatic Responsibilities of ESA

ESA shall use reasonable efforts to fulfil the responsibilities below:

Provide NASA with input for the Project Service Level Agreement requesting Deep Space Network (DSN) coverage for Mars Express tracking and data capture support.

5.2 Support and participate in the development of technical information required to undertake communications support activities involving NASA's 2001 Odyssey, ESA's 2003 Mars Express, and NASA's MER-2003 missions. These support activities shall address functional requirements, tests, and other associated activities to ensure interoperability among the relevant ESA and NASA mission elements.

5.3 Equip the Mars Express orbiter with a dedicated UHF Radio Telecommunications Relay Subsystem and operate this system to permit relay communication with NASA Mars assets from the time after Mars Express orbit insertion until October 2005. The mutually agreed requirements for, and services provided by such a system are specified in the UHF Radio Telecommunications Relay Subsystem User Requirements Specification, MEX-EST-RS-5009.

5.4 Provide an interface between the DSN and the European Space Operations Centre (ESOC) for Mars Express support in terms of command and telemetry services that conforms to the Consultative Committee for Space Data Systems (CCSDS) Spacelink Extension (SLE) service standard.

5.5 Identify and establish the required ground interfaces between the NASA mission operations center and the ESOC.

5.6 Support radio compatibility tests between the Mars Express transponder and the DSN.

5.7 Design the Mars Express Orbiter and provide consumables for a baseline mission of one Martian Year, starting in December 2003, with the intention of extending the orbiter mission for an additional Martian Year.

5.8 Provide relay communications sufficient to test and characterize the communications to and from the NASA MER-2003 rovers and the Mars Express Orbiter.

5.9 Ensure compatibility of the Beagle 2 UHF system with the Odyssey UHF system to enable transfer of commands and telemetry through Odyssey to and from Beagle 2.

5.10 Establish a control programme to assure Electromagnetic Compatibility (EMC) between the Mars Express spacecraft and the MARSIS instrument.

5.11 Ensure the provision to NASA of advance review data packages and provide access to all information necessary for the conduct of any joint ESA-NASA independent review of a Mars Express element.

5.12 Establish, by the time of launch, an international Mars Express Participating Scientists programme open to U.S. scientists. Subject to the submission of acceptable proposals, the results of peer review, and the availability of NASA or other funding sources for U.S. scientists, ESA shall select U.S. scientists as participants. ESA shall invite a NASA observer to the peer review process.

5.13 Inject the Mars Express Orbiter into an elliptical orbit enabling communications between December 2003 and October 2005 with NASA surface elements.

5.14 Support delivery of ASPERA, HRSC, PFS, SPICAM, MaRS, MARSIS, Beagle 2, and OMEGA, and any other data, as appropriate, to NASA or to appropriate U.S. Co-Investigators for processing and for archiving to the Planetary Data System (PDS). ESA also shall support scientific community compliance with its agreement to provide appropriate scientific data and Mars Express data products in a PDS compliant format, in accordance with Article 10 below.

5.15 Support the exchange of tracking, command, telemetry navigation data and voice transmissions between the Parties.

5.16 Support studies, as mutually agreed, to ensure interoperability of orbital and surface elements on Mars, and other studies, such as the UHF test identified in 6.11 below, that may arise from the cooperation addressed in this MOU.

5.17 Provide to NASA proper documentation and Launch Certification(s) to develop information sufficient for NASA to satisfy relevant launch safety and environmental policies.

5.18 For the use of radiological materials on any portion of the mission, provide to NASA proper documentation and Launch Certification(s) that ensure that appropriate nuclear safety considerations are incorporated into the launch system and mission designs.

5.19 Provide to NASA all pertinent or referenced technical information relevant to the above undertakings, in accordance with Article 9 below.

**Article 6**
**Programmatic Responsibilities of NASA**

NASA shall use reasonable efforts to fulfil the responsibilities below:

6.1 Support and participate in the development of technical information required to undertake communications support activities involving NASA's 2001 Odyssey, ESA's 2003 Mars Express, and NASA's MER-2003 missions. These support activities shall address functional requirements, tests, and other associated activities to ensure interoperability among the relevant ESA and NASA mission elements.

6.2 Provide DSN tracking and data capture support for the Mars Express Orbiter and provide associated technical information. The level of support shall be determined through the NASA DSN Resource Allocation process and shall be provided for as long as this MOU is in force.

6.3 For the Mars Express Orbiter, provide:

a. High accuracy Differential One-way Range (Delta DOR) navigation support.

b. Approach navigation support for the Mars Express Orbiter.

c. NASA-derived tracking data types based on data acquired through 6.3.a and 6.3.b above for ESA validation of its navigation performance.

d. As mutually agreed, independent cross-verification of navigation, consultancy on pre- and post-launch navigation support, consultancy on interplanetary operational issues and necessary tracking data produced from the NASA DSN to ESA.

e. Provide all relevant technical and review information as required to support 6.3.a-d.

6.4 For the Beagle 2 lander:

a. Participate, as mutually agreed, in an independent review of the Beagle 2 lander and other Mars Express elements as requested by ESA. The results of these reviews shall be documented in a written narrative signed report. Unless a NASA contribution is affected, NASA would not be a party to implementing any of the accepted review recommendations.

b. Provide one Beagle 2 airbag engineering drop test.

c. Provide relay communications support sufficient to test and characterize the communications to and from the Mars Express Beagle 2 using NASA's 2001 Odyssey mission.

d. Assess the technical and programmatic feasibility of Beagle-2 operational communications support during the initial operations phase, and provide Beagle 2 communications relay support on a best-efforts, non-interference basis for up to the first 21 days of Beagle 2 surface operations.

6.5 Identify and establish the required ground interfaces between the NASA mission operations center and the ESOC.

6.6 Support studies, as mutually agreed, to ensure interoperability of orbital and surface elements on Mars, and other studies that may arise from the cooperation addressed in this MOU.

6.7 Advise ESA on planetary protection implementation options for Mars missions, if requested and based on available resources.

6.8 Implement planetary protection guidelines for MARSIS and ASPERA-3 components provided by NASA; these activities shall meet ESA/Astrium Payload Interface Document-A requirements.

6.9. Support, through a separate agreement with ASI, development and ASI-delivery of the ASI/NASA MARSIS, and documentation needed to interface with the Mars Express Orbiter.

6.10 Support, through separate agreements with ESA Member States, U.S. hardware for the ASPERA-3 investigation and Co-Investigators for the SPICAM, PFS, HRSC, MaRS, and Beagle 2 investigations.

6.11 Study the feasibility of using the Stanford University's UHF antenna to verify the functionality of the Mars Express spacecraft UHF system through an in-orbit telecommunications test.

6.12 Support radio compatibility tests between the Mars Express transponder and the DSN.

## Article 7
## Management

7.1 ESA has established a Mars Express Project Office at its European Space Research and Technology Centre (ESTEC) located in The Netherlands. The ESA Mars Express Project Manager, who is responsible for the overall execution of the Mars Express mission, heads

the Project Office. The Mars Express Project office is responsible for the implementation of ESA policy guidelines and the establishment of milestones as they relate to Principal, Co-, and Interdisciplinary Investigators and the fulfilment of the ESA responsibilities identified herein.

7.2 NASA has established a Mars Exploration Program Office, headed by the Mars Exploration Program Director, within the Office of Space Science at NASA Headquarters. NASA also has named a Mars Express Program Executive who is responsible for fulfilling NASA's responsibilities under this MOU and the overall management of NASA's participation in the Mars Express mission. This individual's responsibilities include the implementation of policies, establishment of milestones and management of the Mars Express mission related activities funded by NASA to ensure accomplishment of the mission objectives, including the fulfilment of the NASA responsibilities identified herein.

7.3 NASA has established a Mars Express/NASA Project Office located at the Jet Propulsion Laboratory (JPL) in Pasadena, California. The Mars Express/NASA Project Office is headed by the Mars Express/NASA Project Manager, who on behalf of the Mars Express Program Executive at NASA Headquarters, is responsible for the implementation of NASA activities identified in this MOU.

7.4 NASA has named a Discovery Program Office Manager, located in the NASA Management Office at JPL. This individual supports ASPERA-3 instrumentation development under the auspices of the NASA Discovery Program and coordinates activities with the Mars Express/NASA Project Manager.

7.5 ESA has designated a Mars Express Project Scientist. NASA has separately designated a Mars Express Program Scientist at NASA Headquarters and a Project Scientist at JPL. For the purpose of this MOU the ESA Mars Express Project Scientist is the direct counterpart of the NASA Mars Express Program Scientist.

7.6 Following the selection of the Mars Express investigations, ESA has established a Mars Express Science Working Team, SWT, chaired by the ESA Project Scientist. The Mars Express Orbiter Principal Investigators of flight instruments, the Lander Lead Scientist, and the AO-selected Interdisciplinary Scientists are all members of the Mars Express SWT.

7.7 The programmatic and technical implementation of this MOU shall be described in the ESA/NASA Mars Express Programme Plan prepared by ESA and NASA and approved by the ESA Mars Express Project Manager and NASA Mars Express Program Executive.

## Article 8
## Reviews

8.1 Mars Express implementation is based on a classical review cycle. It includes the following major reviews:

| | |
|---|---|
| Requirements Review | June 1999 (Completed) |
| Preliminary Design Review | November 1999 – January 2000 (Completed) |
| Beagle 2 Independent System Review | September 2000 (Completed) |
| Hardware Status Verification | October 2000 (Completed) |
| Orbiter Instrument and Lander Critical Design Reviews | July - September 2000 (Completed) |
| Instrument Critical Design Review | Late 2000 - early 2001 (Completed) |
| Mission/spacecraft Critical Design Review | July 2001 (Completed) |
| Flight Acceptance Review | January 2003 |
| Flight Readiness Review | April 2003 |

8.2 NASA shall be invited to participate in those reviews that involve and/or have a significant influence on NASA's contributions and shall be invited to the Flight Acceptance and Flight Readiness Reviews, and other such reviews as appropriate.

**Article 9**
**Exchange of Goods and Technical Data**

The Parties are obligated to transfer only those technical data (including software) and goods necessary to fulfil their respective responsibilities under this MOU, in accordance with the following provisions:

9.1 The transfer of technical data (including software) for the purpose of discharging the Parties' responsibilities with regard to interface, integration, and safety shall normally be made without restriction, except as required by national laws and regulations relating to export control or the control of classified data. If design, manufacturing, and processing data and associated software, which are proprietary but not export controlled, are necessary for interface, integration, or safety purposes, the transfer shall be made and the data and associated software shall be appropriately marked. Nothing in this MOU requires the Parties to transfer goods or technical data contrary to national laws and regulations relating to export control or control of classified data.

9.2 All transfers of proprietary data and export-controlled goods and technical data are subject to the following provisions. In the event a Party finds it necessary to transfer goods which are subject to export control or technical data which is proprietary or subject to export controls, and for which protection is to be maintained, such goods shall be specifically identified and such technical data shall be marked with a notice to indicate that they shall be used and disclosed by the receiving Party and its related entities (e.g., contractors and subcontractors) only for the purposes of fulfilling the receiving Party's responsibilities under the Mars Express mission implemented by this MOU, and that the identified goods and marked technical data shall not be disclosed or retransferred to any other entity without the prior written permission of the furnishing Party. The receiving Party shall abide by the terms of the notice, and shall protect any such identified goods and marked technical data from unauthorized use and disclosure, and shall also obtain these same obligations from its related entities prior to the transfer.

9.3 All goods, marked proprietary data, and marked technical data subject to export control, which are transferred under this MOU, shall be used by the receiving Party and the receiving Party's related entities exclusively for the purposes of the Mars Express mission as implemented by this MOU.

## Article 10
## Rights in and Distribution of Scientific Data

10.1 Science data obtained by the Mars Express mission investigators are to be released to the international scientific community after a period of no longer than six months. The six-month period begins with the receipt by the Principal Investigators of usable science data, ground-based and flight calibration data, and any associated Mars Express data in a form suitable for analysis. At the end of this period, the scientific data shall become publicly available as specified in 10.2 below.

10.2 Mars Express mission investigators shall share data with other investigators of the Mars Express mission, including Interdisciplinary Scientists and Participating Scientists, to enhance the scientific return from the mission under procedures defined by the Mars Express Science Working Team. Following the six-month period defined in 10.1 above, all scientific and ancillary Mars Express data records shall be deposited with the Mars Express Science Data Library and NASA's Planetary Data System (PDS).

10.3 Scientific results of Mars Express mission investigations shall be made available to the scientific community in general through publication in appropriate journals or other established channels of communication. Such publications and reports shall include a suitable acknowledgement of the services afforded by the Parties. Copies of all publications and reports will be placed in ESA's data library and NASA's National Space Science Data Center (NSSDC). In the event such publications or reports are protected by copyright, the Parties shall have a royalty-free right to reproduce, distribute, prepare derivative works of and use the copyrighted works for their own purposes.

10.4 The Parties shall have the right to use the data, processed and unprocessed, at any time, for support of their respective responsibilities but shall not prejudice the mission investigators' first publication rights, which are established in accordance with paragraph 10.1 above.

10.5 The Parties and their investigators shall have immediate access to scientific data obtained by their respective investigations.

## Article 11
## Inventions and Patents

Nothing in this MOU shall be construed as granting or implying any rights to, or interest in, patents or inventions of the Parties or their contractors or subcontractors.

## Article 12
## Public Information

12.1 The Parties shall develop joint communications guidelines prior to launch to ensure a consistent and coordinated means of working with the media and general public regarding cooperative activities undertaken pursuant to this MOU by them and/or all participants to the Mars Express mission. Each Party undertakes to coordinate with the other, in advance, those public information activities which relate to the other Party responsibilities or performance in the Mars Express mission. In all relevant media activities, the contributions of each Party to the Mars Express mission shall be acknowledged.

12.2 Implementing arrangements for these public information activities shall be agreed upon separately.

## Article 13
## Financial Arrangements

Each Party shall bear the costs of discharging its respective responsibilities under this MOU, including travel and subsistence of its own personnel and transportation of goods and equipment and associated documentation, for which it is responsible. The Parties' obligations hereunder are subject to their respective funding procedures and the availability of appropriated funds. Should either Party encounter budgetary problems in the course of its respective internal procedures that may affect the activities carried out under this MOU, that Party shall notify and consult with the other Party in a timely manner in order to minimise the negative impact of such problems on the cooperation.

## Article 14
## Customs Clearance and Ownership

14.1 In accordance with the laws and regulations governing the Parties, each Party shall facilitate free customs clearance and waiver of all applicable customs duties and taxes for equipment and related goods necessary for the implementation of this MOU. In the event that any customs duties or taxes of any kind are nonetheless levied on such equipment and related goods, such customs duties or taxes shall be borne by the Party related to the authority levying such customs duties or taxes. The Parties' obligation to ensure duty-free entry and exit of equipment and related goods is fully reciprocal.

14.2 Regarding customs clearance associated with the launch from Kazakhstan, ESA shall be responsible for any and all taxes, fees, and other charges of whatever nature assessed by Russian and/or Kazakhstan authorities on equipment and other items entering or leaving Russia or Kazakhstan.

14.3 Each Party shall retain ownership of all the goods, hardware and software including associated technical data and any Ground Support Equipment, GSE, it provides to the other Party under the terms of this MOU, without prejudice to any individual rights of ownership of the Parties' respective related entities as defined in Article 15.2 b below.

## Article 15
## Liability

15.1 The Parties agree that a comprehensive cross-waiver of liability between the Parties and their related entities shall further participation in space exploration, use, and investment. The cross-waiver of liability shall be broadly construed to achieve this objective. The terms of the waiver are set out below.

15.2 As used in this Article:

a. The term "Party" has the meaning specified in the Preamble;

b. The term "related entity" means:

(i) a contractor, subcontractor or sponsored entity of a Party at any tier;
(ii) a user or customer of a Party at any tier;

(iii) a contractor or subcontractor of a user or customer or sponsored entity of a Party at any tier; or
(iv) scientific investigators.

The term "related entity" may also include another State or an agency or institution of another State, where such State, agency or institution is an entity as described in (i) through (iv) above or is otherwise involved in the activities undertaken pursuant to this MOU.

The terms "contractors" and "subcontractors" include suppliers of any kind.

c. The term "damage" means:

(i) bodily injury to, or other impairment of health of, or death of, any person;
(ii) damage to, loss of, or loss of use of any property;
(iii) loss of revenue or profits; or
(iv) other direct, indirect, or consequential damage;

d. The term "launch vehicle" means an object or any part thereof intended for launch, launched from Earth, or returning to Earth which carries payloads or persons, or both;

e. The term "payload" means all property to be flown or used on or in a launch vehicle; and

f. The term "Protected Space Operations" means all activities pursuant to this MOU, including launch vehicle activities and payload activities on Earth, in outer space, or in transit between Earth and outer space. "Protected Space Operations" begin at the entry into force of this MOU and end when all activities done in implementation of this MOU are completed. It includes, but is not limited to:

(i) research, design, development, test, manufacture, assembly, integration, operation, or use of launch or transfer vehicles, payloads, or instruments, as well as related support equipment and facilities and services;

(ii) all activities related to ground support, test, training, simulation, or guidance and control equipment and related facilities or services.

The term "Protected Space Operations" excludes activities on Earth that are conducted on return from space to develop further a payload's product or process for use other than for the Mars Express mission.

15.3.a Each Party agrees to a cross-waiver of liability pursuant to which each Party waives all claims against any of the entities or persons listed in sub-paragraphs (i) through (iii) below based on damage arising out of Protected Space Operations. This cross-waiver shall apply only if the person, entity, or property causing the damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations. The cross-waiver shall apply to any claims for damage, whatever the legal basis for such claims, including but not limited to delict and tort, and contract, against:

(i) the other Party;
(ii) a related entity of the other Party;
(iii) the employees of any of the entities identified in sub-paragraphs (i) and (ii) immediately above.

b. In addition, each Party shall extend the cross-waiver of liability as set forth in sub-paragraph 15.3.a above to its own related entities by requiring them, by contract or otherwise, to agree to waive all claims against the entities or persons identified in sub-paragraphs 15.5.a (i) through 15.3.a (iii) above.

c. For avoidance of doubt, this cross-waiver of liability shall be applicable to liability arising from the Convention on International Liability for Damage Caused by Space Objects, which entered into force on 1 September 1972, where the person, entity, or property causing the damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations.

d. Notwithstanding the other provisions of this section, this cross-waiver of liability shall not be applicable to:

(i) claims between a Party and its own related entity or between its own related entities;
(ii) claims made by a natural person, his/her estate, survivors, or subrogees for bodily injury, other impairment of health or death of such natural person;
(iii) claims for damage caused by wilful misconduct;
(iv) intellectual property claims;
(v) claims for damage resulting from a failure of the Parties to extend the cross-waiver of liability as set forth in sub-paragraph 15.3.b or from a failure of the Parties to ensure that their related entities extend the cross-waiver of liability as set forth in sub-paragraph 15.3.b; or
(vi) contract claims between the Parties based on the express contractual provisions.

e. Nothing in this Article shall be construed to create the basis for a claim or suit where none would otherwise exist.

f. In the event of third-party claims for which the Parties may be liable, the Parties shall consult promptly to determine an appropriate and equitable apportionment of any potential liability and on the defence of any such claims.

## Article 16
## Registration - Jurisdiction and Control

ESA shall register the Mars Express Orbiter and Beagle 2 lander in accordance with the Convention on Registration of Objects Launched into Outer Space, which entered into force on 15 September 1976. ESA shall retain jurisdiction and control over the space objects that it registers.

## Article 17
## Mishap Investigation

In the case of a mishap or mission failure, the Parties agree to provide assistance to each other in the conduct of any investigation. In the case of activities that might result in the death of, or serious injury to persons, or substantial loss of, or damage to property as a result of activities under this MOU, the Parties shall establish a process for investigating each such mishap as part of their programme/project-level implementation plans.

## Article 18
## Amendment

This MOU may be amended by written agreement of the Parties.

## Article 19
## Consultation and Settlement of Disputes

The Parties shall consult with each other promptly when events occur or matters arise, which may occasion a question of interpretation or implementation of the terms of this MOU. Any dispute in

the interpretation or implementation of the terms of this MOU shall be first referred to the ESA Mars Express Project Manager and the NASA Mars Express Program Executive. If necessary, the dispute shall then be referred to the ESA Director of the Scientific Programme and the NASA Associate Administrator for Space Science, or their designees. Any dispute, which cannot be resolved at this level, shall be referred to the Director General of ESA and the Administrator of NASA. Failing agreement at that level, the Parties may agree to refer the dispute to arbitration, conciliation or mediation.

**Article 20**
**Entry into Force, Duration, and Termination**

20.1 This MOU shall enter into force upon signature by the Parties. It shall remain in force until 31 December 2008, unless extended by mutual written agreement or terminated in accordance with paragraph 20.2.

20.2 Either Party may terminate this MOU at any time by giving the other Party at least 12 month's written notice of its intent to terminate. It may be extended for such additional periods as may be mutually agreed through an exchange of letters. Termination of this MOU shall not affect a Party's continuing obligations under Articles 9, Exchange of Goods and Technical Data; 10, Rights in and Distribution of Scientific Data; 11, Inventions and Patents; 14, Customs Clearance and Ownership; and 15, Liability, unless otherwise agreed by the Parties. ESA shall notify NASA six months ahead of the official termination of the Mars Express mission.

Done in duplicate, in the English language.

Done at: Paris / Washington

Date: 18 December 2002

For the
National Aeronautics and Space
Administration of the United States

For the
European Space Agency